FORM PTO-1390 (REV 10-94) U S DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER: 111869-00113

U.S. APPLICATION NO.: 09/622942

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/GB99/00567	2 March 1999	2 March 1998

TITLE OF INVENTION
LAMINTED MILD STEEL STRIP

APPLICANT(S) FOR DO/EO/US
Brian J. BASTABLE, Malcolm R. MALLACE and Ieuan S. REES

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This express request to begin national examination procedures (35 U.S.C. 371(f) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application is filed (35 U.S.C. 371(c)(2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau.
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☐ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An **executed** oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A **FIRST** preliminary amendment.
    ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information: Copies of: Form PCT/RO/101; WO 99/44756 (PCT/GB99/00567 as published); International Search Report (published 25.11.99); Form PCT/IPEA/416 (Trans. if IPER); Form PCT/IPEA/409 (IPER with annexes); Two (2) Forms PCT/IB306 (reflecting change of address and change of name of Applicant)

U.S. APPLICATION NO. 09/622942	INTERNATIONAL APPLICATION NO PCT/GB99/00567	ATTORNEY'S DOCKET NO. 111869-00113

17. ☒ The following fees are submitted:

CALCULATIONS PTO USE ONLY

BASIC NATIONAL FEE (37 CFR 1.492(a)(1)-(5)):

Search Report has been prepared by the EPO or JPO $840.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) $670.00

No international preliminary examination fee paid to USPTO (37 CFR 1.482) but international search fee paid to USPTO (37 CFR 1.445(a)(2)) $760.00

Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO $970.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(2)-(4) ..... $ 96.00

ENTER APPROPRIATE BASIC FEE AMOUNT =				$840.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(e)).				$	
CLAIMS	NUMBER FILED		NUMBER EXTRA	RATE	
Total Claims	28	- 20 =	0	X $18.00	$144.00
Independent Claims	1	- 3 =	0	X $78.00	$0.00
MULTIPLE DEPENDENT CLAIM(S) (if applicable)				+ $260.00	$n/a
TOTAL OF ABOVE CALCULATIONS =					$984.00
Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28).					$n/a
SUBTOTAL =					$840.00
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). +					$
TOTAL NATIONAL FEE =					$984.00
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28,3.31). **$40.00** per property +					$40.00
TOTAL FEES ENCLOSED =					$1,024.00
				Amount to be refunded:	$
				charged:	$

a. ☒ A check in the amount of $ 1,024.00 to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. _____ in the amount of $_____ to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 23-2185 . A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

Signature:

SEND ALL CORRESPONDENCE TO:
CUSTOMER NO.: 002779
BLANK ROME COMISKY & MCCAULEY LLP
WIGMAN, COHEN, LEITNER & MYERS IP GROUP
900 - 17th Street, N.W., SUITE 1000
Washington, D.C. 20006

Charles R. Wolfe, Jr.
NAME

28,680 / August 24, 2000
Registration No. / Date

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
U.S. PCT DESIGNATED/ELECTED OFFICE (DO/EO/US)

In re U.S. National Stage Appln. of	:	
	)	
Brian J. BASTABLE et al.	:	
	)	
Serial No.: Not Yet Assigned	:	
	)	
Filing Date: August 24, 2000	:	Attorney Docket: 111869-00113
	)	
Int'l. Appln. No. PCT/GB99/00567	:	
	)	
Int'l. Filing Date: 2 March 1999	:	
	)	
For: LAMINATED MILD STEEL STRIP	:	

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

Prior to an examination on the merits of the above-referenced U.S. national stage patent application, and any calculation of filing fees, please amend this application as follows.

IN THE SPECIFICATION:

Page 1, after the title and before line 1, please insert the following headings:

--**BACKGROUND OF THE INVENTION**

Field of the Invention--; and

after line 4, please insert the following heading:

--Description of Related Art--.

Page 3, after line 7, please insert the following heading:

--**SUMMARY OF THE INVENTION**--.

IN THE CLAIMS:

Please amend Claims 3, 5, 6, 12-14, 18-22, 24 and 26-28 as follows:

3. (Amended) A process according to [any one of the preceding claims] claim 1, wherein the strip has a gauge of between 0.08 and 0.50mm.

5. (Amended) A process according to [any one of the preceding claims] claim 1, wherein the strip is cleaned electrolytically.

6. (Amended) A process according to [any one of the preceding claims] claim 1, wherein the chemical coating is applied to the strip by a method of immersion, spraying, roller coating, or a combination thereof.

12. (Amended) A process according to [any one of the preceding claims] claim 1, wherein the strip is chemically treated at a temperature of less than 100°C.

13. (Amended) A process according to [any one of the preceding claims] claim 1, wherein the strip is chemically treated to form an anti-corrosive, adhesion promoting chemical coating between the strip and thermoplastic resin.

14. (Amended) A process according to [any one of the preceding claims] claim 1, wherein the oxyanion coating comprises a phosphate, a chromate, an oxalate or an arsenate.

18. (Amended) A process according to [any one of the preceding claims] claim 1, wherein the chemical coating comprises less than 5 atomic % chromium.

19. (Amended) A process according to [any one of the preceding claims] claim 1, wherein the chemically-treated strip is rinsed and/or dried prior to organic resin coating.

20. (Amended) A process according to [any one of the preceding claims] claim 1, wherein one or more layers of thermoplastic resin are applied to one or both sides of the chemically-treated strip.

21. (Amended) A process according to [any one of the preceding claims] claim 1, wherein the layer or layers of thermoplastic resin is/are melted and rapidly quenched to attain the required degree of crystalline structure.

22. (Amended) A process according to [any one of the preceding claims] claim 1, wherein the chemically-treated strip is extrusion coated with at least one thermoplastic resin.

24. (Amended) A process according to [any one of the preceding claims] claim 1, wherein the chemically-treated strip is coated with thermoplastic resin together with a bonding layer.

26. (Amended) A process according to claim 24 [or claim 25] wherein the thickness of the bonding layer is between 1 and 10 μm.

27. (Amended) A process according to [any one of the preceding claims] claim 1, wherein the thermoplastic resin comprises polypropylene (PP), polyethyleneterephthalate (PET) or a combination thereof.

28. (Amended) A process according to [any one of the preceding claims] claim 1, wherein the thickness of the layer, or layers, of thermoplastic resin is/are between 3 and 50 gm.

REMARKS

By the foregoing amendments, Applicants have amended the specification to add headings in accordance with preferred U.S. patent application format.

Further, Applicants have amended Claims 3, 5, 6, 12-14, 18-22, 24 and 26-28 to delete the multiple dependency and reduce the filing fee.

Applicants retain all rights to the subject matter covered by the canceled multiple dependent claims by making these claims directly dependent on a single claim. The subject matter now not included in these claims may be reintroduced as multiple dependent claims or as separate independent or dependent claims in the present application or in a continuation and/or divisional application.

Finally, Applicants understand that, under the procedures of the PCT, a copy of the priority document, GB9804297.1, has been supplied to the U.S. Patent & Trademark Office pursuant to Rule 17 of the PCT Regulations. It is, therefore, respectfully requested that the first Official Action in the present application contain an indication that the appropriate priority document is in the file of this application.

Prompt, favorable action on the subject application, as presently amended, are earnestly solicited.

Respectfully submitted,

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Date: August 24, 2000

1/PRT

LAMINATED MILD STEEL STRIP

This invention relates to laminated mild steel strip for use especially, but not exclusively, in the packaging industry and to methods of manufacturing such strip. More especially, the invention relates to a method of chemically treating mild steel strip prior to lamination with a thermoplastic material.

Organic-coated metal substrates, for example thermoplastic resin-coated tinplate or blackplate, are used, *inter alia*, in the production of packaging materials, for example, food and beverage cans. As a result, organic coatings so used, are required to conform with strict performance criteria. To maintain the integrity of a can as well as to ensure that its contents are maintained in a suitable condition over a storage period which may span months or even longer, the coating must exhibit good stain resistance, corrosion resistance and resistance to delamination.

GB-A-2329608A discloses a process for producing thermoplastic resin-coated aluminium alloy plate in which the plate is treated sequentially with alkali and acid solutions to put the plate surfaces in such a condition that the increase rate of the specific surface area is 3 to 30%. The treated plate is then subjected to an anodic oxidation treatment prior to lamination with thermoplastic resin.

Organic coatings have traditionally comprised solvent or water-based

lacquers. Recently however, the use of laminated polymer films and coatings, such as thermoplastic resins, has been recognised as a viable alternative.

In practice, organic coatings are not applied directly onto mild steel (otherwise known as blackplate), because for packaging applications the metal surface is too reactive and underfilm corrosion can spread rapidly. Instead, the can-making industry uses *metallic*-coated mild steels, such as tinplate or electrolytically chromium-coated steel (ECCS) as substrates for organic coatings.

Currently, a surface-treated mild steel strip may comprise a chrome/CrO_x or tin layer electrochemically deposited so that the final substrate has either a metallic chromium layer of typically from 50 to 150 mg/m² and a chromium oxide/hydroxide layer of typically from 10 to 30 mg/m², or a layer of metallic tin of typically between 5 and 10 g/m². In many applications it is preferred that tinplate is additionally subjected to chromate solution treatment, the amount of oxidisable chromium being between 1 and 10 mg/m².

Unfortunately, electro-plating pre-treatment is a costly and time consuming process. Not only are materials expensive, but the electro-plating process itself consumes large quantities of energy. In addition, this conventional pre-treatment adds an additional production step in the process line, which adds costs in terms of line-time, manpower and through yield.

It has been shown that for some applications, the degree of protection afforded by the ECCS or tin pre-treatment exceeds the performance requirements of the can. For this reason and the disadvantages associated with electroplating discussed above, there is an increasing desire to develop an alternative metal strip pre-treatment which avoids these problems but maintains the performance requirements of certain classes of food, beverage or aerosol cans. Preferably, any such pre-treatment should be capable of application under

the present day metal strip coating and lamination line conditions.

In the past, there has been a general understanding in the industry that alternatives to electro-deposited tin and/or chrome would afford significantly less substrate protection. However, if a suitable alternative pre-treatment could be found, an electroplating process step would be unnecessary with consequent increases in yield, savings in energy and reductions in the overall production costs of laminated metal strip.

It is an object of the present invention to provide a suitable alternative to conventional electroplating of metal strip prior to coating with an organic resin, which provides adequate corrosion protection of the organically coated metal strip and provides and maintains good adhesion to such organic resin coatings.

According to the present invention in one aspect, there is provided a process for manufacturing laminated mild steel strip, the process comprising the steps of,

(a) cleaning the strip;

(b) chemically pre-treating the cleaned strip to form on one or each of its surfaces a non-metallic chemical coating of an oxyanion to resist corrosion of the underlying mild steel substrate and to promote adhesion to a subsequently applied layer; and,

(c) applying to the chemically-treated strip a coating of thermoplastic resin to form a protective layer on at least one surface thereof.

The term "non-metallic coatings" as used herein refers to coatings which despite optionally including *metal ions*, differ from what is conventionally described as a metallic layer in that there is no *native* metal. Unlike a metal layer wherein metal atoms, through metallic bonding, *solely* form a crystalline structure, in the non-metallic coatings of the present invention, both metallic and non-metallic ions are distributed within an amorphous network.

The strip may be cold-rolled mild steel strip. Mild steel strip is conventionally referred to as blackplate.

Typically, the strip has a gauge of between 0.08 and 0.50mm. A preferred gauge is 0.18mm.

Preferably, the strip is cleaned to remove all traces of contamination which may be present as a result of previous cold rolling and annealing processes. Typically, the strip is cleaned electrolytically using a caustic-based solution, although the nature of the cleaner does not influence the subsequent chemical treatment. After cleaning, the strip may be rinsed with water to remove all traces of the cleaning solution.

The chemical coating may be applied to the strip using a conventional application method such as immersion, spraying, roller coating, or a combination thereof.

Typically, the chemical coating is applied by immersing the cleaned strip in chemical contained in one or more treatment vessels. In one embodiment, the strip is chemically treated for less than 60 seconds; in other embodiments, the chemical treatment times are less than 30 seconds or less than 15 seconds. Preferably, the strip is chemically treated for less than 10 seconds; typically, 5 seconds.

Typically, the strip is chemically treated at a temperature of less than 100°C, most preferably at less than 30°C.

In one aspect of the invention, the strip is chemically treated to form a chemical coating which prevents subsequent underfilm corrosion of the strip and promotes adhesion between the strip and thermoplastic resin. The chemical coating may be referred to as a *coupling agent* since it forms a strong

and durable *chemical bridge* at the interface between the metal substrate and the final organic resin coating. The chemical bridge has a dual role; it interacts with receptive inorganic surfaces to form tenacious chemical bonds at the interface with the metal substrate *and* at the interface with the organic resin coating.

The oxyanion coating may comprise a phosphate, a chromate, an oxalate or an arsenate. Additionally, the coating may comprise yttrium, elements in the lanthanum series of the periodic table, silanes or azoles.

When metal substrates are exposed to the atmosphere, the surface of the metal develops a naturally occurring surface oxide layer. Typically, the oxide layer on blackplate at ambient temperature will have an average thickness of between 2 and 20 mm. Thus, in one embodiment, the chemical coating may be applied to the metal oxide layer on the surface of the metal substrate.

The chemical treatment may comprise, for example zinc orthophosphates, manganese phosphates or iron phosphates, thereby producing crystalline phosphate coatings on the strip.

In a preferred embodiment of the invention the strip is chemically coated with a composition comprising less than 5% atomic chromium.

After chemical treatment, the strip may be rinsed and/or dried, for example with hot air, prior to treatment with organic resin.

One or more layers of thermoplastic resin may be applied to one or both sides of the chemically-treated strip. The layer or layers of thermoplastic resin may be melted and rapidly quenched to attain the required degree of crystalline structure.

Typically, a film of thermoplastic resin may be co-extruded with the chemically-treated strip to form laminated strip. The film of thermoplastic resin may be bonded to chemically-treated strip under conditions of elevated temperature and pressure.

The chemically-treated strip may be coated with a thermoplastic resin together with a bonding layer. The bonding layer may comprise a polyester, or an acid or acid-anhydride polyolefin resin containing carboxyl or anhydride groups. Typically, the bonding layer is between 1 and 10μm thick.

Alternatively, the chemically-treated strip may be extrusion coated with at least one thermoplastic resin.

Preferred thermoplastic resins comprise polypropylene (PP), polyethyleneteraphthalate (PET) or a combination thereof.

Typically, the thickness of the layer, or layers, of thermoplastic resin are between 3 and 50μm.

The chemical treatment has two functions; firstly it provides corrosion protection and inhibits underfilm corrosion, and secondly, it promotes good adhesion between the organic resin coating and the strip. These properties combined with the barrier properties of the organic coating provide a laminated metal strip product which can be formed into components for a range of applications whilst maintaining adequate performance criteria with regard to corrosion resistance and inter layer adhesion during the lifetime of the products.

Therefore, in another aspect, the invention provides a laminated strip produced by a process which comprises the steps of chemically treating the strip to form on at least one of its surfaces a non-metallic coating, and applying to that coated surface a coating of a thermoplastic resin to form a layer thereon.

The invention will now be described by way of example only with reference to the accompanying diagrammatic drawings and tables in which:-

Figure 1 is a histogram showing the performance rating of food-filled cans made from PET-laminated and chemically treated blackplate;

Figure 2 is a histogram showing the performance rating of food-filled cans made from PP-laminated and chemically treated blackplate; and,

Table 1 tabulates the conditions, concentrations and dipping times of exemplary chemical treatments.

A process line for producing laminated blackplate comprises a plurality of guide rollers for transporting a strip of blackplate continuously from a coiled roll to an exit coil via a multiplicity of vertical tanks. These tanks include a cleaning tank, rinsing tanks and a chemical treatment tank. The line speed is typically 10 to 100 metres per minute with a treatment dwell time of between 1 to 10 seconds. After hot-air drying, the chemically treated strip is laminated with organic polymeric resin e.g. a thermoplastic resin such as PET at elevated temperature and pressure. The laminated strip is then rapidly quenched to produce an essentially amorphous organic outer coating.

By way of example, the performances of two commercially available chemical treatments (referred to below as chemicals A and B) were evaluated as potential alternatives to the conventional electroplating step in the production of an organically coated mild steel strip.

Chemical A comprised a commercially available chemical treatment comprising chromium, silicon and organic active species. Chemical B comprised a commercially available chemical treatment comprising a two component

organic polymer i.e. an acrylic polymer and $(NH_3)Cr_2O_6$.

In the evaluation, blackplate of 0.08 to 0.50mm thickness was subjected to an electrolytic cleaning process using a commercial cleaning solution at a temperature not exceeding 100°C, by passing a current of 20A for 5 seconds. This treatment is considered to return current densities to approximately 10 Adm^{-2}. The nature of the cleaner employed on the blackplate does not influence any subsequent chemical treatment. It is important that the strip is clean and free of contamination from prior processing. Before dipping in the chemical treatment vessels, the samples were washed in two ambient water rinse tanks. The concentrations of the cleaner and chemical treatments were those recommended by the respective suppliers. A batch of samples exposed only to electrolytic cleaning were also prepared as a control sample group, identified in Figures 1 and 2 as B-plate.

As well as "cleaned only" samples, an ECCS control sample group was also laminated. Samples of both 15 μm PET and/or 40 μm PP were laminated at elevated temperature and pressure. The hot samples were plunged into cold water just as the current was switched off. Instant quenching of this nature has the effect of retaining the amorphous nature of the thermoplastic coating at ambient temperature. Table 1 illustrates the concentrations, dip times and treatment section temperatures for evaluated chemicals A and B.

Samples of each variable were subjected to a wedge bend test. Both treatments A and B performed equally well; no delamination or cracking of the polymer was observed. A standard Erichsen and cross scored Erichsen were also performed. The samples were evaluated for signs of blisters and/or delamination. Again, both A and B performed well with little to distinguish between them.

About 350, 73mm diameter classic can ends were produced on a

conventional MB20 can end press. Approximately 20 samples of each treatment with both PET and PP were produced. A standard lining compound was applied to each end. Half the ends were lightly scored prior to filling with foodstuff to create a standard defect and potentially allow a greater degree of differentiation of the chemical treatments on opening.

8oz cans (73 x 63mm) were filled with either rabbit cat food or cut green beans in salt brine under standard filling conditions. The cans were stored on their sides at an elevated temperature (37°C). Cans with scored ends were stored with the score running vertically so that it entered the head space area. Four cans of each variable were opened after 2, 5, and 15 weeks. Opened cans were evaluated for sulphide staining, delamination and corrosion (on and off the score line).

The can end performance was judged on three main criteria (sulphide staining, delamination and corrosion (on and off the score line)) using a points system. Three points were awarded if the defect was obviously present and two points if the defect was only minor. No points were allocated if the defect was absent. All points were totalled for each category of defect over the three openings, for both polymer film types and for each chemical pre-treatment. The results are illustrated in Figure 1 and Figure 2.

It should be noted that the performance rating system used here gives equal weighting to each of the attributable defects. Arguably, sulphide staining could be regarded as a less serious defect than delamination as it is only aesthetic and does not directly reflect can performance. Nevertheless, the approach highlights the chemical treatments which perform relatively adequately for use in can-making applications.

In summary, the trials show that chemical pre-treatment in accordance with the invention provides an effective alternative to metallic electroplated

coatings prior to coating of strip with organic resins.

It may be envisaged that in another embodiment of the invention, blackplate can undergo chemical pre-treatment "off-line" with transfer to the lamination line post treatment. However, this is less cost effective due to the necessity for a separate coating facility and any associated transportation or storage costs.

It will be appreciated that the foregoing is merely exemplary of treatments in accordance with the invention and that modifications can readily be made thereto without departing from the true scope of the invention.

TABLE 1

Chemical Treatment	Working concentration	Dip time (seconds)	Temperature of dip °C
A	3%	1	25
B	as supplied	3	<30

CLAIMS

1. A process for manufacturing laminated mild steel strip, the process comprising the steps of,
   (a) cleaning the strip;
   (b) chemically pre-treating the cleaned strip to form on one or each of its surfaces a non-metallic chemical coating of an oxyanion to resist corrosion of the underlying mild steel substrate and to promote adhesion to a subsequently applied layer; and,
   (c) applying to the chemically-treated strip a coating of thermoplastic resin to form a protective layer on at least one surface thereof.

2. A process according to claim 1 wherein the mild steel strip is cold-rolled.

3. A process according to any one of the preceding claims wherein the strip has a gauge of between 0.08 and 0.50mm.

4. A process according to claim 3 wherein the strip has a gauge of 0.18mm.

5. A process according to any one of the preceding claims wherein the strip is cleaned electrolytically.

6. A process according to any one of the preceding claims wherein the chemical coating is applied to the strip by a method of immersion, spraying, roller coating, or a combination thereof.

7. A process according to claim 6 wherein the chemical coating is applied by immersing the strip into at least one chemical treatment vessel.

8. A process according to claim 7 wherein the residence time of the strip

in the chemical-treatment vessel is less than 60 seconds.

9. A process according to claim 8 wherein the residence time of the strip in the chemical-treatment vessel is less than 30 seconds.

10. A process according to claim 9 wherein the residence time of the strip in the chemical-treatment vessel is less than 15 seconds.

11. A process according to claim 10 wherein the residence time of the strip in the chemical-treatment vessel is less than 10 seconds.

12. A process according to any one of the preceding claims wherein the strip is chemically treated at a temperature of less than 100°C.

13. A process according to any one of the preceding claims wherein the strip is chemically treated to form an anti-corrosive, adhesion promoting chemical coating between the strip and thermoplastic resin.

14. A process according to any one of the preceding claims wherein the oxyanion coating comprises a phosphate, a chromate, an oxalate or an arsenate.

15. A process according to claim 14 wherein the chemical coating includes a two component organic polymer.

16. A process according to claim 14 wherein the chemical coating includes chromium, silicon and an organic active species.

17. A process according to claim 14 wherein the chemical coating comprises a phosphate such as zinc orthophosphates, manganese phosphates or

iron phosphates.

18. A process according to any one of the preceding claims wherein the chemical coating comprises less than 5 atomic % chromium.

19. A process according to any one of the preceding claims wherein the chemically-treated strip is rinsed and/or dried prior to organic resin coating.

20. A process according to any one of the preceding claims wherein one or more layers of thermoplastic resin are applied to one or both sides of the chemically-treated strip.

21. A process according to any one of the preceding claims wherein the layer or layers of thermoplastic resin is/are melted and rapidly quenched to attain the required degree of crystalline structure.

22. A process according to any one of the preceding claims wherein the chemically-treated strip is extrusion coated with at least one thermoplastic resin.

23. A process according to claim 22 wherein the film of thermoplastic resin is bonded to the chemically-treated strip under conditions of elevated temperature and pressure.

24. A process according to any one of the preceding claims wherein the chemically-treated strip is coated with thermoplastic resin together with a bonding layer.

25. A process according to claim 24 wherein the bonding layer comprises a polyester or an acid or acid-anhydride polyolefin resin containing carboxyl

or anhydride groups.

26. A process according to claim 24 or claim 25 wherein the thickness of the bonding layer is between 1 and 10 μm.

27. A process according to any one of the preceding claims wherein the thermoplastic resin comprises polypropylene (PP), polyethyleneterephthalate (PET) or a combination thereof.

28. A process according to any one of the preceding claims wherein the thickness of the layer, or layers, of thermoplastic resin is/are between 3 and 50 μm.

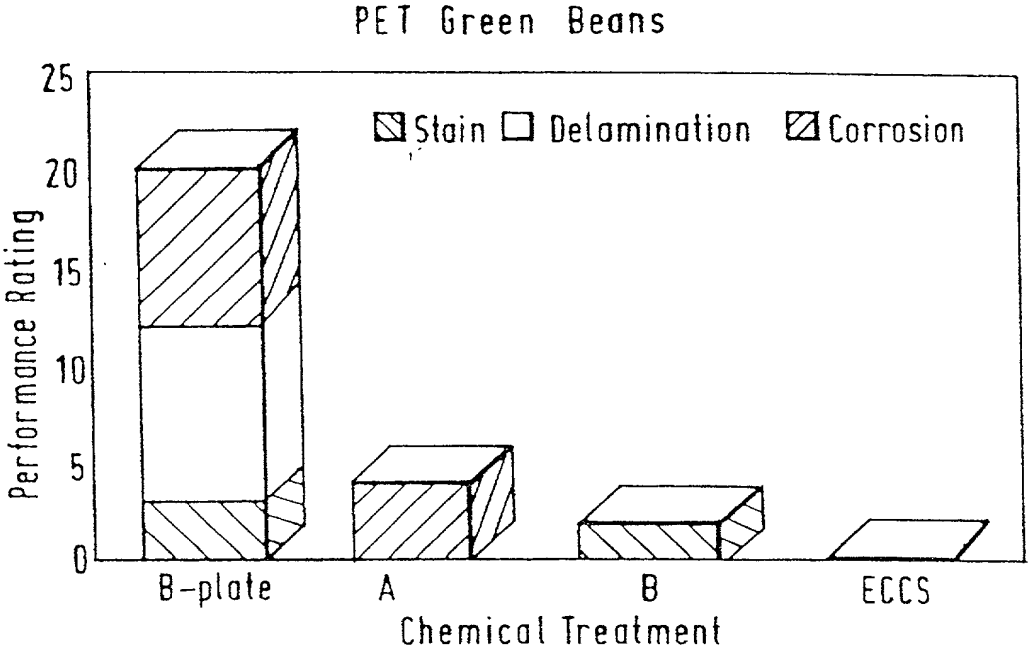
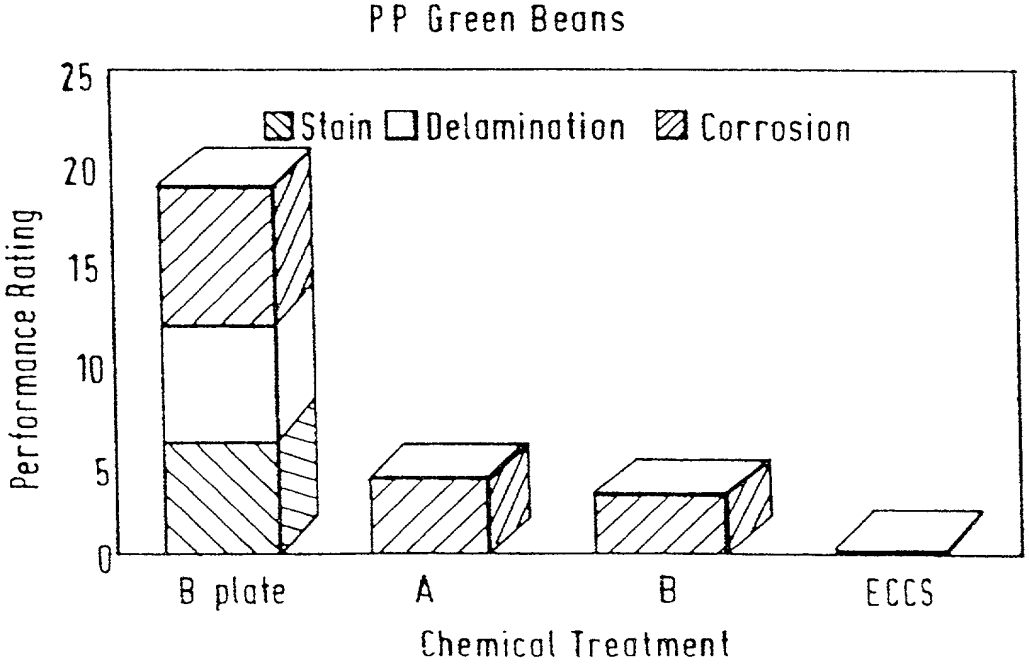

PET Green Beans
25
20
15
10
5
0
Performance Rating
Stain
Delamination
Corrosion
B-plate
A
B
ECCS
Chemical Treatment

Fig.1.


PP Green Beans
25
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Performance Rating
Stain
Delamination
Corrosion
B plate
A
B
ECCS
Chemical Treatment

Fig.2.

U.S.A. P57223F

Attorney Docket Number: _____

DECLARATION FOR PATENT APPLICATION

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

LAMINATED MILD STEEL STRIP

the specification of which

- ☐ is attached hereto
- * ☐ was filed on _____ as United States Application Number or PCT International Application Number _____ and (if applicable) was amended on _____

I hereby authorize our attorneys to insert the serial number assigned to this application.

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56.

I hereby claim foreign priority benefits under 35 U.S.C. §119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 USC §119			
APPLICATION NO.	COUNTRY	DAY/MONTH/YEAR FILED	PRIORITY CLAIMED
9804297.1	Great Britain	02. 03. 1998	YES

I hereby claim the benefit under 35 U.S.C. §119(e) of any United States provisional application(s) listed below.

PROVISIONAL APPLICATION(S) UNDER 35 U.S.C. §119(e)	
APPLICATION NUMBER	FILING DATE

I hereby claim the benefit under 35 U.S.C. §120 of any United States application, or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. §112.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR §1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

PRIOR U.S./PCT INTERNATIONAL APPLICATION(S) DESIGNATED FOR BENEFIT UNDER 37 U.S.C. §120		
APPLICATION NO.	FILING DATE	STATUS — PATENTED, PENDING, ABANDONED
* PCT/GB99/00567	02.03.1999	Pending

I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith: Herbert Cohen, Reg. No. 25,109; Victor M. Wigman, Reg. No. 25,201; George C. Myers, Jr., Reg. No. 27,040; Donald R. Greene, Reg. No. 22,470; Michael C. Greenbaum, Reg. No. 28,419; Charles R. Wolfe, Jr., Reg No. 28,680; Michael D. White, Reg. No. 32,795; Karl O. Neidert, Reg. No. 39,313; David J. Edmondson, Reg. No. 35,126; Denise C. Lane, Reg. No. 42,780; Carl Schaukowitch, Reg. No. 29,211; James E. Howard, Reg. No. 39,715; Peter Weissman, Reg. No. 40,220 and Nicholas Bromer, Reg. No. 33,478.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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☐ Additional joint inventors are named on separately numbered sheets attached hereto.